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Children with Recurrent Respiratory Tract Infections Tend to Belong to Families with Health Problems

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ABSTRACT. Söderström, M., Hovelius, B. and Prellner, K. (Department of Community Health Sciences, Dalby, and Department of Oto-Rhino-Laryngology, University of Lund, Sweden). Children with recurrent respiratory tract infections tend to belong to families with health problems. Acta Paediatr Scand 80: 696, 1991.

Children (7–11 years of age) who had recurrent respiratory tract infections (RTI) treated with antibiotics as preschoolers ($n=41$), and their families were compared with regard to medical and social factors to families with children of comparable age who had had no such infections as preschoolers, or only isolated episodes (controls; $n=29$). All the children studied had attended day-care centres as preschoolers. The two groups of children did not differ with regard to socio-economic conditions or age at admission to day-care centres. There was a difference in the two groups with regard to signs noted at physical examination ($p<0.05$), eardrum changes being observed in 34% of the children with recurrent episodes of RTI as preschoolers and in none of the controls ($p<0.001$). Questionnaires answered by parents indicated diseases, particularly cardiovascular diseases, to be significantly more frequent in the families of the children with recurrent RTIs as preschoolers than in those of the controls ($p<0.01$). Parents of the controls were more often satisfied with their own health ($p<0.05$) and reported fewer symptoms of minor illness ($p<0.05$), as compared with parents of the children with recurrent RTIs as preschoolers. Thus, the results of the present study support the idea that children with recurrent bacterial RTIs as preschoolers tend to belong to families with health problems. *Key words: respiratory tract infection, family health, day-care centre.*

Some preschool children seem to be exceptionally prone to recurrent respiratory tract infections (RTI) while others remain relatively free from such infections. A relationship has been suggested to exist between the frequency of RTI and a number of factors, such as sex and age of the child, family size (1), socio-economic status (2), parental smoking (3, 4), acute or persistent family stress (5) and form of day-care attended by the child (6, 7). A close relationship has been found to exist between "child physician utilization" and "maternal physician utilization" (8).

The aim of the study has been to assess some medical and social factors in families with children who as preschoolers attended day-care centres and had recurrent episodes of antibiotic-treated RTI, and compare these with a control group of families with children who had no such RTI or only isolated episodes. The assessment was done by means of a questionnaire answered by the parents, clinical examination of the children, and scrutiny of their medical records.

SUBJECTS AND METHODS

Of 395 school-age children belonging to the 1975–79 birth cohorts, who had attended day-care centres as preschoolers (1980–82), and who had been prospectively followed owing to their participation in a study of pneumococcal immunization (9), 70 children were enrolled in the present study which started in 1986. The children included in the immunization study were recruited from 66 day-care centres in the municipalities of Lund attended by approximately 4000 children. Children with chronic or progressive diseases or known immunological disor-

ders had been excluded, as had children with cleft palate. On the basis of their infection history during the day-care period, two age-matched groups were selected: one group, defined as RTI-afflicted as preschoolers (i.e., ≥ 4 episodes of RTI treated with antibiotics during the years 1980–82), and a control group, where the children included were defined as non-RTI-afflicted as preschoolers (i.e., ≤ 2 episodes of RTI treated with antibiotics during the 1980–82 period, and ≤ 2 episodes prior to their enrolment in the immunization study in 1980).

Of the 135 children thus selected, 19 had moved from the Lund area in the interim, leaving 116 children and their families to be invited to participate in the two-year follow-up study. Participation was declined in 46 cases (22 children with a high number of antibiotic-treated RTIs and 24 with no antibiotic-treated RTI or only isolated episodes), the most common reasons given for non-participation being lack of time and aversion for blood, throat and nasopharyngeal sampling. Of the remaining 70 children 41 were included in the group of RTI-afflicted children (25 boys, 16 girls; mean age = 9.1 years; median age = 9 years) and 29 in the control group (19 boys, 10 girls; mean age = 9.0 years; median age = 9 years). They were invited to a physical examination, accompanied by one of their parents who answered a questionnaire. Nineteen (46%) of the RTI-afflicted children and 19 (68%) of the control group had been vaccinated during the immunization study with the 14-polyvalent pneumococcal vaccine. The difference in proportion between the groups was nonsignificant.

Medical histories from birth to the start of the present study were collected from one or more of the following sources after permission from the parents: the paediatric, ear-nose-throat and infectious diseases clinics, local community health centres and the emergency reception centre.

The physical examination included a routine check of the skin, lymph-nodes in the neck, of the respiratory system, and the heart. The ear-nose-throat examination included otomicroscopy and screening audiography (20 dB). Blood pressure was measured with a cuff of appropriate size after 10 min of rest. Body mass index was determined. Children with cardiac murmur were re-examined by a paediatric cardiologist.

Questionnaire. Parents gave written answers to the questionnaire prior to the examination of their child at the community health centre. The investigator (M. S.) checked that all questions were answered. The questionnaire was designed to elicit details concerning family size, age of parents and sibling(s), length of time the children had been solely breast-fed (i.e., no supplementary bottle), age at admission to day-care centres, living conditions, family smoking habits, socio-economic status, the educational level of both parents and current school situation of the child. The classification of the socio-economic status in the two groups was based on the occupations of the parents (10).

The parents were asked to list any occurrence of infections, allergy, kidney disease, gastrointestinal disease, cardiovascular disease (hypertension, myocardial infarction, angina pectoris, stroke), diabetes mellitus, rheumatoid arthritis, cancer or other diseases in the family (parents, grandparents and siblings). They were also asked about what they perceived as chronic disease, among themselves, the enrolled child, and its siblings.

The parents' attitude to their own current situation was elicited with a question concerning their satisfaction with their own health, current family situation, family economy, social life, and quality of leisure time activities. A five-point Likert scale was employed: very satisfied, reasonable satisfied, neither satisfied nor dissatisfied, somewhat dissatisfied, very dissatisfied. The occurrence of minor symptoms of illness (headache, abdominal pain, dizziness, and sleeping disorders) experienced by the child or the parent at least once every fortnight, were noted (yes or no answers). Any sick leave taken by either parent during the past twelve months was also reported.

Statistical methods. Either Fisher's exact test or the Mann-Whitney's rank sum test (one or two-tailed, depending on the question) was used to compare data from the two groups.

RESULTS

Respiratory tract infections in the children. The mean number of antibiotic-treated RTIs per child from birth to the end of the immunization study (1982) was 12.2 (median = 13; range = 4–23; quartiles Q1=8, Q3=15) in the RTI-afflicted children and 1.4 (median = 1; range = 0–4; Q1–Q3=0–3) in the control group. The mean number of antibiotic-treated RTIs from birth to the start of the present study (1986) for the two groups of children were 16.7 (median = 16; range = 6–31;

Q1–Q3=11–21) in the RTI-afflicted children and 2.6 (median = 2; range = 0–7; Q1–Q3=0.5–4) in the control group. The majority of antibiotic-treated RTIs had been diagnosed as acute otitis media, acute tonsillitis, purulent nasopharyngitis, bronchitis or bronchopneumonia. One child among the RTI-afflicted had been treated for a Haemophilus influenzae epiglottitis.

Clinical findings among the children. As shown in Table 1, various signs were observed more frequently in the RTI-afflicted children than in the controls. One child from the control group had a ventricular septum defect. Cardiac murmur in 16 children was diagnosed as being of physiological origin. One of the RTI-afflicted children had unilateral total deafness following an episode of parotitis, and another had a neurogenic hearing defect. No hearing impairment was found among the remaining children. There was no difference in systolic/diastolic blood pressure between the group of RTI-afflicted children as preschoolers and controls (109/60 (SD = 10/11) and 109/59 (SD = 9/14), respectively). Body mass index was identical: 16.8 (kg/m^2) (SD = 2.2) for both groups.

Familial and social factors. The questionnaire was generally answered by the mother, in 35 (85%) of the cases in the RTI-afflicted group and in 26 (89%) of the cases in the control group. The two groups differed little with regard to family characteristics (Table 2). The mean age of parents in both groups was equal. Most of the children were living in single-family dwellings (private houses). Two families with RTI-afflicted children had changed their living conditions since 1982 because of the illness of their children and had moved to the countryside. Ten children belonging to the RTI-afflicted group, compard to none in the control group ($p<0.01$), had shifted from day-care centres to family day-care or home care during the preschool years, in two cases the reason being the child's recurrent RTIs. For the remaining children the reason was a change in the family situation, e.g., a baby was born into the family. One child among the RTI-afflicted and two of the controls required special assistance at school in such basics as reading, writing and mathematics.

Family health. Significantly more diseases, particularly cardiovascular diseases,

Table 1. *Signs noted at routine physical examination of school-age children with a history of recurrent respiratory tract infection (RTI-afflicted as preschoolers) as compared with controls*

Signs	RTI-afflicted $n=41$ (%)	Controls $n=29$ (%)	Difference[a]
Enlarged tonsils	9 (22)	2 (7)	NS
Sclerotic plaque, scarred eardrum(s) or tympanostomy tubes	14 (34)	0	$p<0.001$
Palpated lymphoglandulae in the neck	14 (34)	9 (31)	NS
Pulmonary ronchi, auscultatory abnormalities	7 (17)	3 (10)	NS
Cardiac murmur	11 (27)	6 (20)	NS
Eczema, atopic skin	8 (20)	3 (10)	NS
Any combination of the above	30 (73)	13 (45)	$p<0.05$

[a] Fisher's exact test (two-tailed).

were reported in the families of RTI-afflicted children than in those of controls (Table 3). Hypertension was reported in 19 grandparents of the RTI-afflicted and in 5 grandparents of the control children. Angina pectoris/myocardial infarction was reported in 30 grandparents of the RTI-afflicted children and in 10 of the control children, respectively. Three parents of RTI-afflicted children, but none of the parents of controls, reported themselves to be suffering from a chronic disease (malignant melanoma, leucopenia with recurrent infectious diseases, and spondylosis). Siblings of five RTI-afflicted children were reported to have a chronic disease, as compared with two siblings of controls (NS; Fisher's exact test, one-tailed).

Parents of the RTI-afflicted children were less satisfied with their own health than were parents of controls ($p = 0.03$; Mann-Whitney rank sum test, one-tailed). Nineteen (66%) parents of the controls described themselves as very satisfied with their health, as compared with 17 (41%) of the parents of RTI-afflicted children. There were no differences between the groups with regard to the remaining com-

Table 2. *Social and demographic factors relating to children (7–11 years of age) with a history of recurrent respiratory tract infections as preschoolers (RTI-afflicted) as compared with controls*

	RTI-afflicted ($n=41$) n (%)	Controls ($n=29$) n (%)	Difference
Family characteristics			
Average family size (per.)	4.1 (SD=0.6)	4.2 (SD=0.8)	NS
No. of first-born children in group	22 (54)	10 (35)	NS
No. of single children in group	7 (17)	2 (7)	NS
Divorced/non-divorced	4/37	4/25	NS
Socio-economic characteristics			
Father			
Manual worker	4 (10)	8 (28)	NS
Non-manual employee or self-employed	37 (90)	21 (72)	NS
University educated	32 (78)	13 (45)	$p<0.01$
Mother			
Manual worker	10 (24)	5 (17)	NS
Non-manual employee	31 (76)	24 (83)	NS
University educated	23 (56)	17 (59)	NS
Living conditions			
Single-family house	35 (85)	26 (89)	NS
Building constructed after 1974	21 (51)	10 (35)	NS
Other factors			
Father currently a smoker	11 (27)	7 (24)	NS
Mother currently a smoker	4 (10)	9 (31)	$p<0.05$
Smoking at home > 5 cigs/day	8 (20)	7 (24)	NS
Breast-fed only (months)	3.6 (SD=2.6)	3.7 (SD=2.9)	NS
Average age (months) at admission to day-care centre	21.5 (SD=13.4)	23.8 (SD=16.5)	NS

mon matters (work, current family situation, social life, and quality of leisure time activities).

The number of parents who stayed at home sick at least once during the previous twelve months did not differ significantly between the two groups (28% and 20% of the RTI-afflicted and control groups, respectively). Both parents had stayed at home sick in 5 of 37 (14%) families of RTI-afflicted children, as compared with 1 of 25 (4%) families of controls (NS: Fisher's exact test, one-tailed).

Reported symptoms of minor illness (Table 4) were more frequent among parents of RTI-afflicted children than among those of controls.

Table 3. *Number of relatives (parents, siblings and grandparents) with diseases, as reported by parents to 41 RTI-afflicted children as preschoolers and 27[a] children in a control group*

Type of disease	Number of relatives in RTI-afflicted group ($n=293$) n (%)	Control group $n=195$ n (%)	p-value[b]
Infectious diseases	20 (7)	5 (3)	0.36
Allergic diseases	40 (14)	17 (9)	0.31
Rheumatoid arthritis and other immunological diseases	11 (4)	4 (2)	0.46
Cardiovascular diseases	51 (17)	17 (9)	0.009
Diabetes mellitus	7 (2)	1 (1)	0.45
Cancer	7 (2)	2 (1)	0.47
Any combination of the above	117 (40)	39 (20)	0.002

[a] Two adopted children excluded.
[b] Mann-Whitney rank sum test, two-tailed.

Table 4. *Symptoms of minor illness occurring relatively often (at least once a fortnight) in parents (P) and children (C), as reported by parents of 41 RTI-afflicted children as preschoolers and 29 controls. (Figures given are number of instances, with percentages in brackets.)*

Symptoms	RTI-afflicted		Controls	
	P $n=40$[a] n (%)	C $n=40$[a] n (%)	P $n=29$ n (%)	C $n=29$ n (%)
Headache	12 (30)	5 (13)	5 (17)	2 (7)
Abdominal pain	7 (18)	5 (13)	1 (3)	1 (3)
Insomnia	3 (8)	0	1 (4)	3 (10)
Dizziness	2 (5)	0	0	0
Any combination of the above	19 (48)[b]	7 (18)	7 (24)[b]	4 (14)

[a] One parent declined to answer these questions.
[b] $p<0.05$ (Fisher's exact test, one-tailed).

DISCUSSION

The present results suggest that children who have suffered from recurrent bacterial RTIs as preschoolers belong to families in which morbidity is high and health problems generally prevalent. This might be a reflection of environmental factors and/or genetic predisposition, involving increased susceptibility both to RTI and to other diseases. The tendency to report symptoms of minor illness and take sick leave more often in the families with a RTI-afflicted child than in those of the controls lends additional support to the conclusion that children who had reccurent bacterial RTIs as preschoolers belong to families with health problems.

It may be argued that the method used did not select children who had recurrent RTI only, but also included children using the medical services frequently for other reasons. However, 80% of the children's physician attended visits 1980–82 were made to one of two experienced ear-nose-throat doctors, which supports the assumption that the majority of the episodes treated with antibiotics were of bacterial etiology. Furthermore, the ear drum changes found in 34% of the children defined as RTI-afflicted as preschoolers may be regarded as sequelae of otitis media, which suggests that these children had had bacterial infections to a higher extent than had the controls.

As all the children studied attended day-care centres as preschoolers, they had had similar opportunities to be exposed to contagious agents. Other studies have shown that younger children attending day-care centres contract more infections than do older ones (6, 7, 11), which is also true of children not attending day-care centres (1). As the average age at admission do day-care centres did not differ between the two groups, this factor hardly explains the difference in the frequency of RTI. In a recent study, Harsten et al. (12) found that the child's age at the initial episode of acute otitis media, and not his or her attendance at day-care centres seemed to be the major indicator of susceptibility to recurrent otitis media.

Despite the selected character of our study population, the social background was largely the same for the RTI-afflicted children and the controls, and typical of families with children attending day-care centres in Sweden (13).

The smoking habits of parents, particularly those of mothers, have been related to both upper and lower RTI and to impaired pulmonary function among their growing children (3, 14). In the present study, however, fewer of the mothers of RTI-afflicted children were still smokers than were mothers of controls. The habit of smoking has been reported to have declined among educated people in Sweden in recent years (15). Thus, the mothers of children defined as RTI-afflicted as preschoolers in our study may have changed their smoking habits owing to their child's susceptibility to RTI, while the need to stop smoking might not have appeared as urgent to the mothers of controls. Accordingly, the effect of passive smoking on the frequency of RTI during the day-care period of the children could not be evaluated.

The impact of pneumococcal vaccination is another factor possibly affecting susceptibility to RTI (9). The difference between the groups concerning number of children immunized and of those given placebo was non-significant in the present study, but the percentage of immunized children was somewhat higher in the control group. The immunization study showed a reduction in the overall frequency of upper RTI in children older than two years at vaccination (9).

In this study, we found diseases to be more frequent in the families of children who had been RTI-afflicted as preschoolers than in those of controls, which may indicate that genetic factors play a role. Familial aggregation, both of cardiovascular

diseases, cancer and otitis media has been reported (16, 17, 18, 19). Our findings seem to support the assumption that some families are more vulnerable than others to disease. According to Huygen's (20) experience from his family practice during 30 years, families do not only differ in their readiness to call for professional medical help, but also in their readiness to fall prey to all kinds of diseases.

All parents, except those of the adopted children, answered the questions concerning diseases in the extended family. It might be argued, however, that the reliability of the information about family health, usually provided by the mothers, might have differed between the groups of parents. A family with a child suffering frequently from bacterial RTIs may have more occasions to consider or discuss diseases, not only that of the child but also those of other members of the family; thus such parents might tend to report family disease history more exhaustively than parents of healthy controls. Mothers of low socio-economic status tend to apply a selective censorship when informing about family health (21). As the social background was equal among mothers in both groups we found no reason to believe that the accuracy of information given concerning family health would differ.

Another important aspect is the consequences of recurrent RTIs. Even if several of the RTI-afflicted children had suffered many episodes of acute otitis media affecting the eardrums, they manifested no hearing impairment for that reason and were doing well at school, findings supported by some studies indicating that recurrent otitis media do not result in lasting developmental impairment (22).

In conclusion, we found recurrent antibiotic-treated RTIs in the children studied to be more related to the prevalence of health problems in their respective families than to social or demographic factors. As some families are more vulnerable to diseases than others, it seems to be valuable for the physicians to be attentive to the health problems in the family of a child consulting for recurrent RTIs.

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